

## WHAT IS CLAIMED IS:

- Swal*
1. An alkali-free glass consisting essentially of, in mass percent, 58-70% SiO<sub>2</sub>, 10-19% Al<sub>2</sub>O<sub>3</sub>, 6.5-15% B<sub>2</sub>O<sub>3</sub>, 0-2% MgO, 3-12% CaO, 0.1-5% BaO, 0-4% SrO, 0.1-6% BaO+SrO, 0-5% ZnO, 5-15% MgO+CaO+BaO+SrO+ZnO, 0-5% ZrO<sub>2</sub>, 0-5% TiO<sub>2</sub>, and 0-5% P<sub>2</sub>O<sub>5</sub>, containing substantially no alkali metal oxide, and having a density of 2.45g/cm<sup>3</sup> or less, an average coefficient of thermal expansion of  $25 \times 10^{-7}/^{\circ}\text{C}$  -  $36 \times 10^{-7}/^{\circ}\text{C}$  within a temperature range between 30 and 380°C, and a strain point not lower than 640°C.
  2. An alkali-free glass according to claim 1, wherein the ratio (BaO+SrO)/BaO falls within a range of 1.1-10 in mass ratio.
  3. An alkali-free glass according to claim 1, wherein the alkali-free glass has a liquidus temperature not higher than 1150°C and a viscosity not lower than  $10^{5.4} \text{ dPa} \cdot \text{s}$  at the liquidus temperature.
  4. An alkali-free glass according to claim 1, wherein the erosion of the alkali-free glass is not greater than 10  $\mu\text{m}$  after treatment by a 10% HCl aqueous solution under the condition of 80°C and 24 hours and neither haze nor roughness of the alkali-free glass is confirmed by visual observation after treatment by a 10% HCl aqueous solution under the condition of 80°C and 3 hours.
  5. An alkali-free glass according to claim 1, wherein the erosion of the alkali-free glass is not greater than 0.8  $\mu\text{m}$  after treatment by a 130 BHF solution under the condition of 20°C and 30 minutes and neither haze nor roughness of the alkali-free glass is confirmed by visual observation after treatment by a 63 BHF solution under the condition of 20°C and 30 minutes.
  6. An alkali-free glass according to claim 1, wherein the alkali-free glass has a specific modulus not smaller than 27.5 GPa/(g  $\cdot$  cm<sup>-3</sup>).

7. An alkali-free glass according to claim 1, wherein the alkali-free glass does not contain  $\text{As}_2\text{O}_3$  but contains 0.5-3.0 wt%  $\text{Sb}_2\text{O}_3 + \text{Sb}_2\text{O}_5 + \text{SnO}_2 + \text{Cl}$ .

8. An alkali-free glass according to claim 1, wherein the alkali-free glass is formed into a plate-like shape by the down-draw process.

9. An alkali-free glass according to claim 1, wherein the alkali-free glass consists essentially of, in mass percent, 60-68%  $\text{SiO}_2$ , 12-18%  $\text{Al}_2\text{O}_3$ , 7-12%  $\text{B}_2\text{O}_3$ , 0-1%  $\text{MgO}$ , 4-10%  $\text{CaO}$ , 0.3-2%  $\text{BaO}$ , 0.1-2.7%  $\text{SrO}$ , 0.4% or more and less than 3%  $\text{BaO} + \text{SrO}$ , 0-0.9%  $\text{ZnO}$ , 5-12%  $\text{MgO} + \text{CaO} + \text{BaO} + \text{SrO} + \text{ZnO}$ , 0-1%  $\text{ZrO}_2$ , 0-1%  $\text{TiO}_2$ , and 0-1%  $\text{P}_2\text{O}_5$ .

10. A glass plate formed by an alkali-free glass consisting essentially of, in mass percent, 58-70%  $\text{SiO}_2$ , 10-19%  $\text{Al}_2\text{O}_3$ , 6.5-15%  $\text{B}_2\text{O}_3$ , 0-2%  $\text{MgO}$ , 3-12%  $\text{CaO}$ , 0.1-5%  $\text{BaO}$ , 0-4%  $\text{SrO}$ , 0.1-6%  $\text{BaO} + \text{SrO}$ , 0-5%  $\text{ZnO}$ , 5-15%  $\text{MgO} + \text{CaO} + \text{BaO} + \text{SrO} + \text{ZnO}$ , 0-5%  $\text{ZrO}_2$ , 0-5%  $\text{TiO}_2$ , and 0-5%  $\text{P}_2\text{O}_5$ , containing substantially no alkali metal oxide, and having a density of  $2.45\text{g/cm}^3$  or less, an average coefficient of thermal expansion of  $25 \times 10^{-7}/^\circ\text{C}$  -  $36 \times 10^{-7}/^\circ\text{C}$  within a temperature range between 30 and  $380^\circ\text{C}$ , and a strain point not lower than  $640^\circ\text{C}$ .

11. A glass plate according to claim 10, wherein the glass plate is used for a flat display.

12. A glass plate according to claim 10, wherein the glass plate has a thickness of 0.6mm or less.

13. A glass plate according to claim 10, wherein the alkali-free glass consists essentially of, in mass percent, 60-68%  $\text{SiO}_2$ , 12-18%  $\text{Al}_2\text{O}_3$ , 7-12%  $\text{B}_2\text{O}_3$ , 0-1%  $\text{MgO}$ , 4-10%  $\text{CaO}$ , 0.3-2%  $\text{BaO}$ , 0.1-2.7%  $\text{SrO}$ , 0.4% or more and less than 3%  $\text{BaO} + \text{SrO}$ , 0-0.9%  $\text{ZnO}$ , 5-12%  $\text{MgO} + \text{CaO} + \text{BaO} + \text{SrO} + \text{ZnO}$ , 0-1%  $\text{ZrO}_2$ , 0-1%  $\text{TiO}_2$ , and 0-1%  $\text{P}_2\text{O}_5$ .

14. A liquid crystal display comprising a glass plate formed by an alkali-free glass consisting essentially of, in mass percent, 58-70%  $\text{SiO}_2$ , 10-19%  $\text{Al}_2\text{O}_3$ , 6.5-15%  $\text{B}_2\text{O}_3$ , 0-2%  $\text{MgO}$ , 3-12%  $\text{CaO}$ , 0.1-5%  $\text{BaO}$ , 0-4%  $\text{SrO}$ , 0.1-6%  $\text{BaO}+\text{SrO}$ , 0-5%  $\text{ZnO}$ , 5-15%  $\text{MgO}+\text{CaO}+\text{BaO}+\text{SrO}+\text{ZnO}$ , 0-5%  $\text{ZrO}_2$ , 0-5%  $\text{TiO}_2$ , and 0-5%  $\text{P}_2\text{O}_5$ , containing substantially no alkali metal oxide, and having a density of  $2.45\text{g}/\text{cm}^3$  or less, an average coefficient of thermal expansion of  $25 \times 10^{-7}/^\circ\text{C}$  -  $36 \times 10^{-7}/^\circ\text{C}$  within a temperature range between  $30$  and  $380^\circ\text{C}$ , and a strain point not lower than  $640^\circ\text{C}$ .

15. A liquid crystal display according to claim 14, wherein the alkali-free glass consists essentially of, in mass percent, 60-68%  $\text{SiO}_2$ , 12-18%  $\text{Al}_2\text{O}_3$ , 7-12%  $\text{B}_2\text{O}_3$ , 0-1%  $\text{MgO}$ , 4-10%  $\text{CaO}$ , 0.3-2%  $\text{BaO}$ , 0.1-2.7%  $\text{SrO}$ , 0.4% or more and less than 3%  $\text{BaO}+\text{SrO}$ , 0-0.9%  $\text{ZnO}$ , 5-12%  $\text{MgO}+\text{CaO}+\text{BaO}+\text{SrO}+\text{ZnO}$ , 0-1%  $\text{ZrO}_2$ , 0-1%  $\text{TiO}_2$ , and 0-1%  $\text{P}_2\text{O}_5$ .

16. A polycrystal silicon TFT liquid crystal display comprising a glass plate claimed in claim 10.